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A METHOD FOR INCREASING THE FIREPOWER OF VIRGINIA CLASS CRUISER--ETC(U)  
UNCLASSIFIED    APR 82    M LEVIN    N00014-76-C-0001  
CNA-PP-350    NL

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Marc Levin

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# A METHOD FOR INCREASING THE FIREPOWER OF VIRGINIA CLASS CRUISERS

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*A*

In August 1980, the Proceedings published an article\* examining the surface warfare capabilities of our surface combatants. Figure 1, reprinted from that article, shows the number of missiles that would be required against a battle group assuming that all of the targets are of equal value, are undefended, and must be hit by at least one attacking missile. The number of missiles required increases rapidly with the number of targets. Rogers and Palermo then showed how additional missiles could be fitted on Perry class frigates by modifying either the structure or the LAMPS Mk III capabilities of the ship.

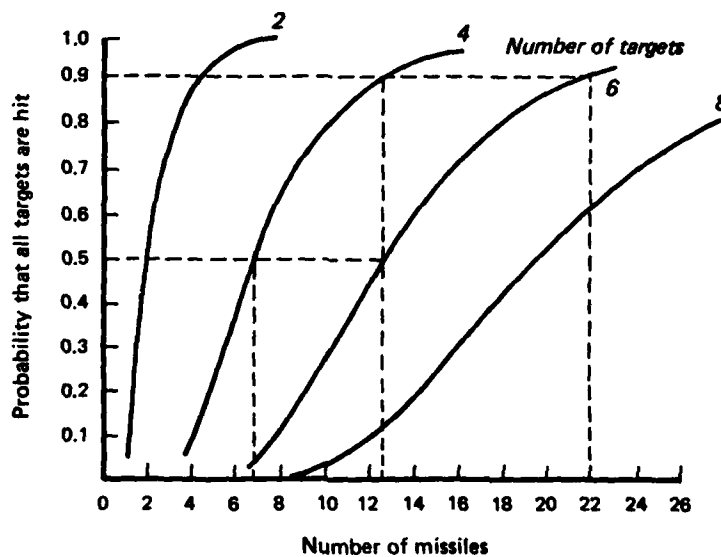


FIG. 1: CRUISE MISSILE FIRING ANALYSES

\*Rogers, Patrick and Palermo, Donald, "Will Our Ships Have Enough Cruise Missile Firepower?" U.S. Naval Institute Proceedings 106 (Aug 1980): 91-96

2 This article examines another possible way of getting additional cruise missile firepower to sea in the near term. Virginia class (CGN 38-41, figure 2) cruisers were chosen because of their unique design--they are the first U.S. ships since World War II designed with a stern hangar. There is no place where additional missiles could be installed on the weather deck without structural changes or limiting the azimuth of the current guns and/or missiles. The hangar, though, provides the opportunity to add two additional quad launchers without modifying the ship's structure. Currently these ships are required to be able to launch, recover, and stow either an SH-2 or SH-3 helicopter. While they regularly recover and launch helos, they have never deployed with a helicopter. The hangars have been used for various other purposes such as a crew's recreation area or as additional storage room. A decision should be made to require these ships to stow a helicopter or alternatively to be able to launch additional cruise missiles.

Figures 3 and 4 picture the Harpoon command and launch subsystem as it is presently installed on many surface ships. The "Grade B" launcher is fitted on cruisers and destroyers while the "Lightweight" launcher is to be installed on all PHM class ships. The difference between the launchers is their ability to withstand shock. The lightweight launcher is significantly narrower and weighs 8,532 pounds versus 13,867 pounds

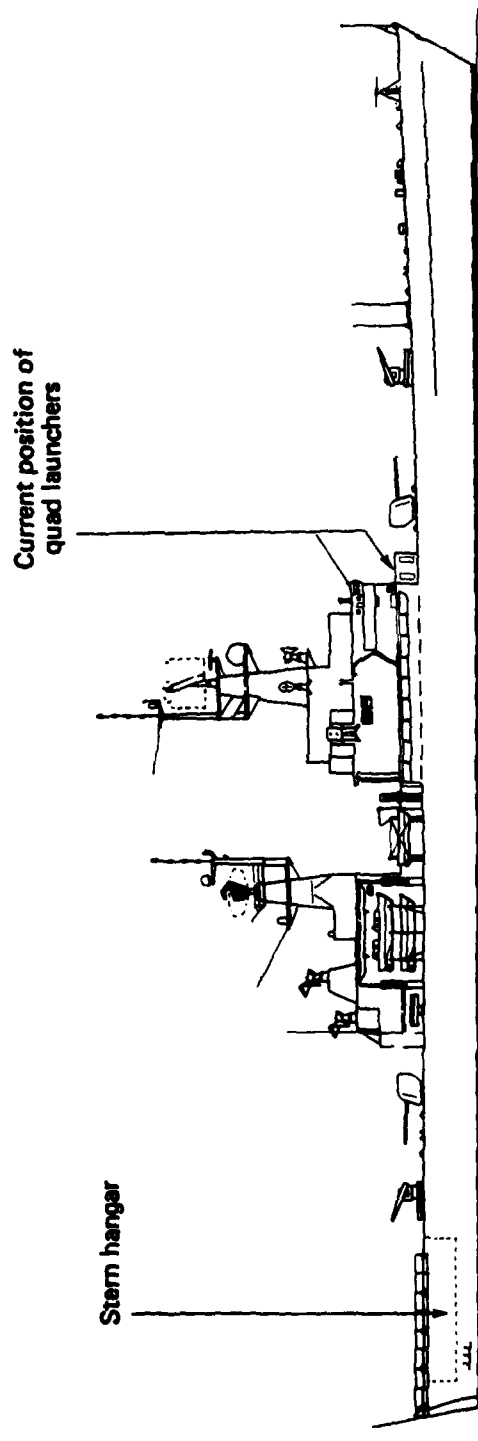


FIG. 2: LINE DRAWING OF VIRGINIA SHOWING CURRENT LAUNCHERS  
AND LOCATION OF HANGAR

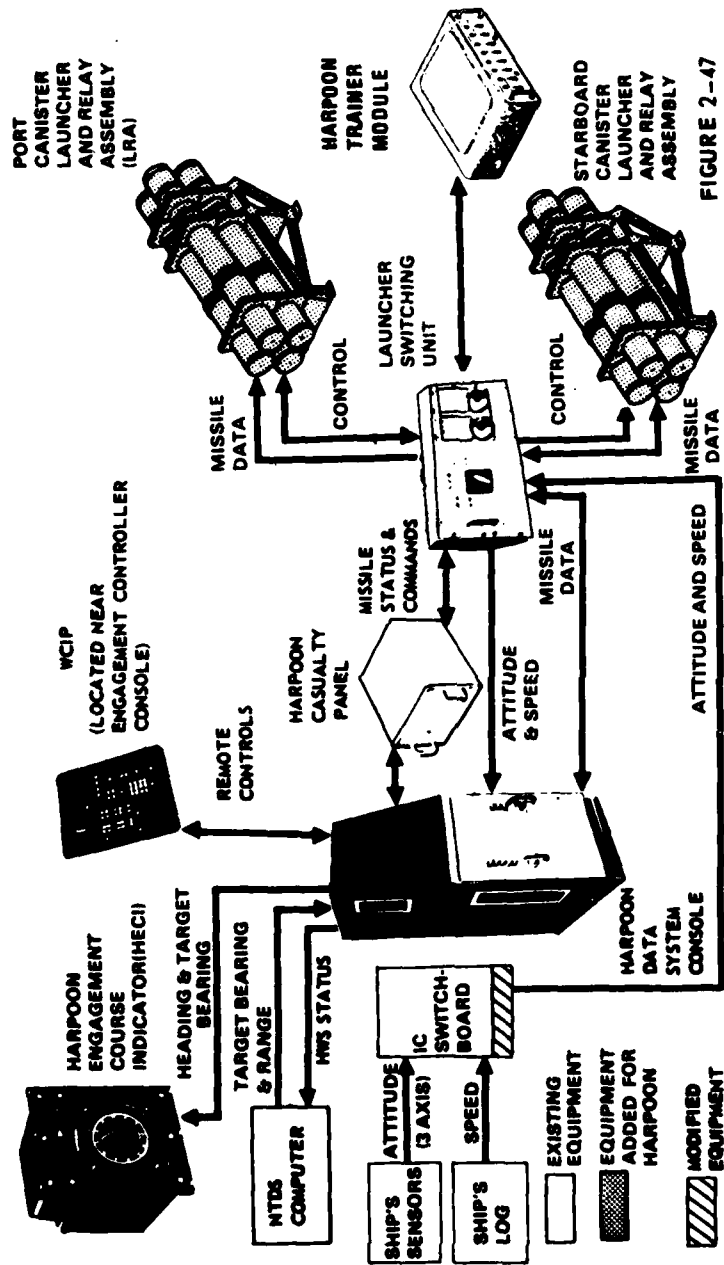
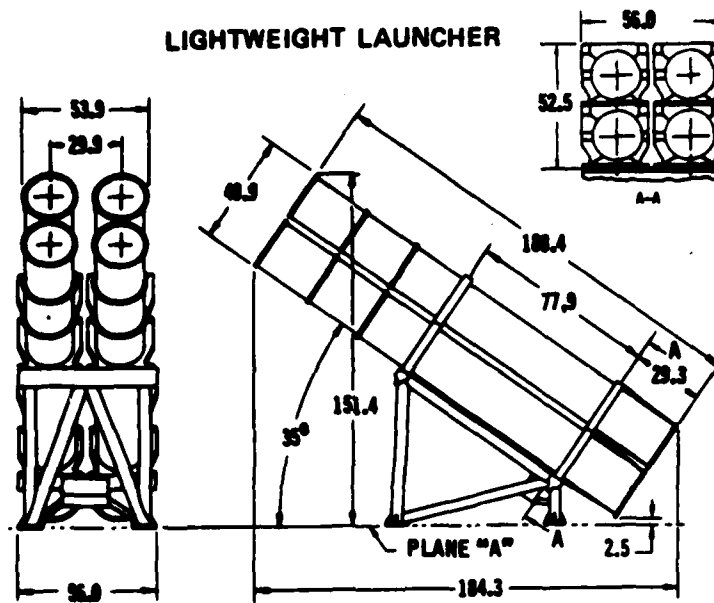


FIGURE 2-47

FIG. 3: HARPOON COMMAND AND LAUNCH SUBSYSTEM



# LIGHTWEIGHT LAUNCHER

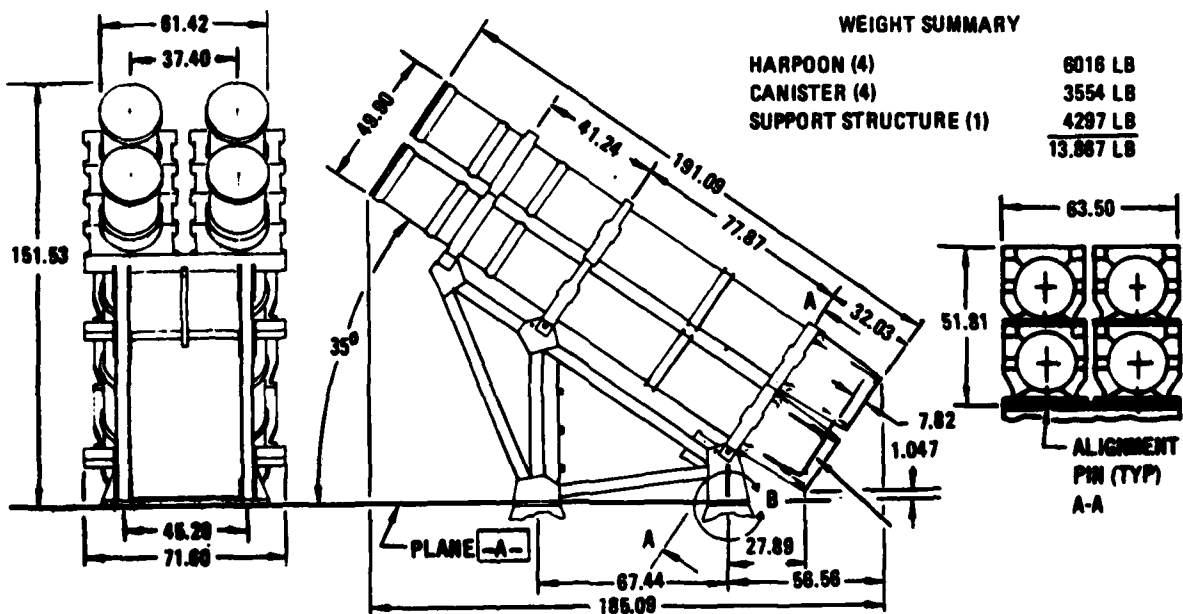


ALL DIMENSIONS IN INCHES

## WEIGHT SUMMARY

HARPOON (4)	6008 LB
CANISTER (4)	1876 LB
SUPPORT STRUCTURE (1)	848 LB
	<u>8532 LB</u>

# GRADE B



## WEIGHT SUMMARY

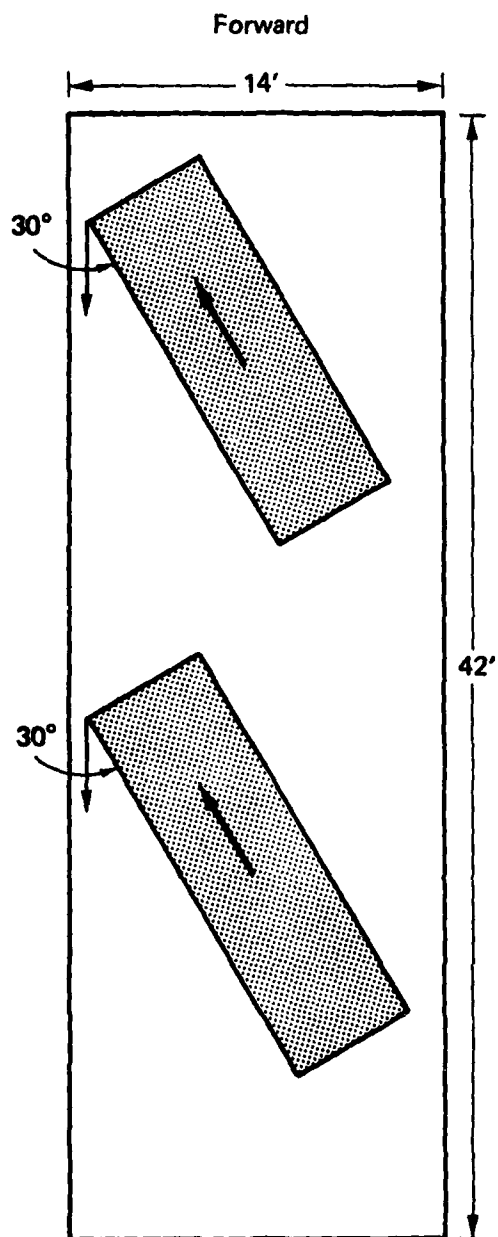
HARPOON (4)	6016 LB
CANISTER (4)	3554 LB
SUPPORT STRUCTURE (1)	4297 LB
	<u>13,867 LB</u>

FIG. 4: HARPOON CANISTER LAUNCHER

for the Grade B launcher. The Virginia class is equipped with a stern hangar that is 42 feet long and 14 feet wide. The weather deck on the fantail folds forward and an elevator is lifted from the third deck using four cables. The elevator is capable of lifting an SH-3 weighing 20,500 pounds but was not able to lift a van of 30,000 pound in a recent trial. Due to the size of the launchers and the limitations of the Harpoon command system, only two launchers could be placed on the elevator. The launchers could be oriented 30 degrees off the centerline.

The Grade B launchers, weighing 13,867 pounds each, are too heavy for the elevator. The lightweight launcher, therefore, would have to be used for this installation. These missiles would be protected in the hangar until ready to fire and then elevated to deck level. They could not withstand as strong a blast as the current launchers while on the deck, but will be adequately protected from the environment and blast while stowed in the hangar.

Figure 5 pictures the additional launchers facing at 150 and 330 degrees relative. (The same results are obtained by placing the launchers at 30 and 210 degrees.) This results in eight missile coverage of all sectors, effectively doubling the current possible salvo size. A more advantageous positioning would put the missiles at 030 and 330 degrees (figure 6). This results in additional firepower in the forward sector where the probability of threat engagement should be higher. As many as



**FIG. 5: ADDITIONAL LAUNCHERS AT 150° AND 330°**

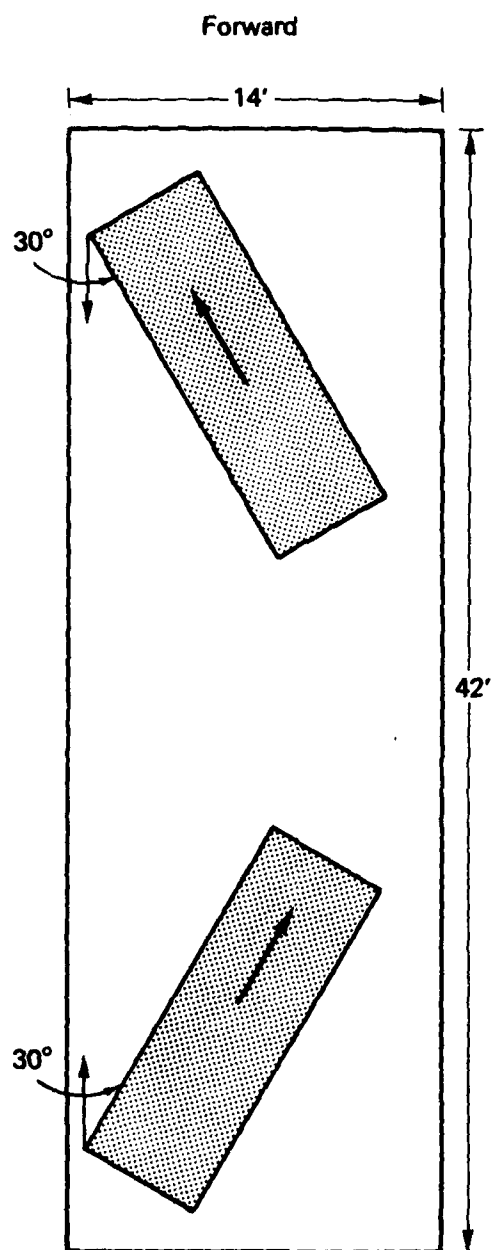
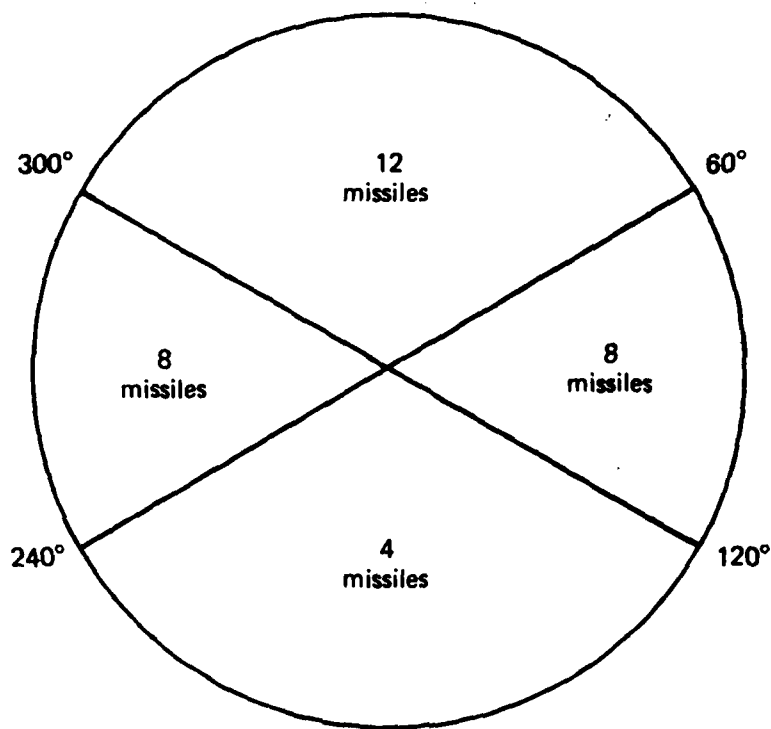


FIG. 6: ADDITIONAL LAUNCHERS AT 030° AND 330°

twelve missiles (figure 7) could be fired in a single salvo with this configuration. Both configurations greatly increase the surface firepower of these ships with only a minor modification. These ships would not be able to stow helicopters. There would be no change, however, in their ability to launch and recover helicopters. Since these ships do not currently (and will not in the foreseeable future) stow helos, such a change would have substantial positive impact on their real operational capability.

In conclusion, this plan provides for additional firepower in the near term at very little cost. Until the arrival of Tomahawk and vertical launch systems, our surface ships are critically lacking in ASUW capabilities and everything possible should be done to correct this.



**FIG. 7: SALVO SIZES POSSIBLE WITH ADDITIONAL  
MISSILES FACING 030° AND 330°**

ONA PROFESSIONAL PAPERS - 1976 TO PRESENT\*

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Slapson, William R., "A Probabilistic Formulation of Murphy Dynamics as Applied to the Analysis of Operational Research Problems," 18 pp., Dec 1978, AD A063 761
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Lee, Lung-Fel, G.S. Maddala, and R. P. Troost, "Asymptotic Covariance Matrices of Two-Stage Probit and Two-Stage Tobit Methods for Simultaneous Equations Models with Selectivity," 13 pp., Jan 1982. (Published in Econometrica, Vol. 48, No. 2 (March, 1980))
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O'Neill, Thomas, "Mobility Fuels for the Navy," 13 pp., Jan 1982. (Accepted for publication in Naval Institute Proceedings)
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Warner, John T. and Goldberg, Matthew S., "The Influence of Non-Pecuniary Factors on Labor Supply," 23 pp., Dec 1981
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Wilson, Desmond P., "The Persian Gulf and the National Interest," 11 pp., Feb 1982
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Lurie, Philip, Troost, R. P., and Berger, Edward, "A Method for Analyzing Multiple Spell Duration Data," 34 pp., Feb 1982
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Troost, Robert P. and Vogel, Robert C., "Prediction with Pooled Cross-Section and Time-Series Data: Two Case Studies," 6 pp., Feb 1982
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Lee, Lung-Fel, Maddala, G. S., and Troost, R. P., "Testing for Structural Change by D-Methods in Switching Simultaneous Equations Models," 5 pp., Feb 1982
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Fletcher, Jean, W., "Navy Quality of Life and Reenlistment," 13 pp., Nov 1981
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Urgoff, Kathy and Thaler, Dick, "The Economics of Multi Year Contracting," 47 pp., Mar 1982 (Presented at the 1982 Annual Meeting of the Public Choice Society, San Antonio, Texas, March 5-7, 1982)
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Rostker, Bernard, "Selective Service and the All-Volunteer Force," 23 pp., Mar 1982
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W. M. Brackenridge, O. Kim Majima, "Collisional Intermultiplet Relaxation of  $Cd(5s5p^3P_{0,1,2})$  by Alkane Hydrocarbons," 7 pp., Jul 1981 (Published in Journal of Chemical Physics, 76(4), 15 Feb 1982)
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Levin, Marc, "A Method for Increasing the Firepower of Virginia Class Cruisers," 10 pp., Apr 1982 (To be published in U.S. Naval Institute Proceedings)
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Coutre, S. E.; Stanford, J. M.; Novis, J. G.; Stevens, P. W.; Wu, T. T., "Possible Three-Dimensional Backbone Folding Around Antibody Combining Site of Immunoglobulin MOPC 167," 18 pp., Apr 1982 (Published in Journal of Theoretical Biology)

PP 352

Barfoot, C. Bernard, "Aggregation of Conditional Absorbing Markov Chains," 7 pp., June 1982 (Presented to the Sixth European Meeting on Cybernetics and Systems Research, held at the University of Vienna, Apr 1982).

PP 353

Barfoot, C. Bernard, "Some Mathematical Methods for Modeling the Performance of a Distributed Data Base System," 18 pp., June 1982 (Presented to the International Working Conference on Model Realism, held at Bad Honnef, West Germany, Apr 1982).

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